

are already situated above the anthers before the opening of the flower.

Whilst in *Myosurus minimus* self-fertilisation is effected by a number of stigmas passing along each of the anthers, *Myosotis versicolor* attains the same effect in the contrary way, all five anthers of the flower passing along the single stigma.

The corolla, when opening, is not only still of a pale yellowish colour, like the buds of other species of *Myosotis*, but even when not yet fully developed the anthers and pistils are mature at the same time and the stigma slightly overtops the corolla. Hence when insects visit the flowers in this state, their probosces always touch the stigma sooner than the anthers, and consequently, when flying to another flower, always cross-fertilise it.

But by the gradual lengthening of the corolla-tube the anthers affixed to its inner side are raised till they surround and self-fertilise the stigma now enclosed in the corolla (Fig. 40). Thus also in this inconspicuous flower the defective cross-fertilisation by insects* is largely supplied by regular self-fertilisation.

HERMANN MÜLLER

INTERNATIONAL METRIC COMMISSION AT PARIS

Melting of the Metal for the new Metric Standards

AT the meeting of the Executive Committee of the International Metric Commission in October last, the fusion of the large single ingot of platinum-iridium, weighing 250 kilogrammes, out of which all the new metric standards were to be constructed, was fixed for the end of the following April, but the completion of the operation was delayed by accidental circumstances until the middle of the following month. As this was the first occasion on which any attempt had ever been made to melt together more than a few kilogrammes of platinum or of platinum alloyed with iridium, it was necessary to make a great number of experimental meltings during the intermediate time in order to secure success in the great operation.

All the actual meltings of the platinum and iridium have been made at the Conservatoire des Arts et Métiers, in a building erected for the purpose. The work has been carried out under the superintendence of M. Tresca, the Sous-Directeur of the Conservatoire, who is also honorary secretary of the Commission, and more immediately intrusted with the technical operations of constructing the new standards. He has had the advantage of the cordial assistance of Mr. George Matthey, of the firm of Johnson and Matthey, Hatton Garden, from whom the large mass of platinum and iridium was obtained. Mr. G. Matthey has had large personal experience in melting platinum, and he remained at Paris from the beginning of April assisting in the work.

It was necessary that the whole of the platinum and iridium should be separately assayed and purified previously to their being melted together. This process was entrusted to M. Henri Sainte-Claire Deville, and carried out at the Ecole Normale, of which he is director. The greatest difficulty in the purification consisted in getting rid of the osmium, which is found in the natural ore in combination with platinum and with iridium. But the chemical difficulty was satisfactorily overcome by M. Deville after many experiments made by him.

The whole of the platinum and iridium had thus been ascertained to be perfectly pure when delivered to M.

Tresca for melting. The first process was to melt portions of the pure platinum, its melting point being about 1,900° C., and considerably lower than that of iridium, which is about 2,400° C. Portions of the platinum were then remelted together with iridium, in the proportions fixed upon of 90 per cent. of platinum and 10 per cent. of iridium. Quantities of from 10 to 15 kilogrammes of platinum-iridium were, in the first instance, melted together. Several of these smaller ingots were then remelted into larger ingots of rather more than 80 kilogrammes each, and the final operation was to remelt three of these larger ingots into a single ingot of 250 kilogrammes.

Each of the meltings was made as nearly as possible of uniform form in a furnace heated with oxy-hydrogen gas. The furnace was made of a block of the ordinary sandy limestone used for buildings in Paris. For the smaller ingots a square block of stone was employed with a hemispherical cavity about 6 in. (15 centimetres) in diameter, for containing the metal. This small block had a cover of similar form, and through its middle was a vertical hole, about $\frac{3}{4}$ in. in diameter, in which the tube for conveying the gas was fixed with mortar. When the metal was placed in the furnace, and the jet of lighted gas directed upon it, sufficient mortar was placed on the joining of the upper and lower blocks of stone to make it air-tight. For the three larger ingots a long oblong furnace was used, with a cavity of the same breadth, but a little deeper and much longer, and three gas-tubes were used. The largest furnace required for the whole quantity of metal had six gas-tubes, each about 1 in. in diameter, inserted in the upper block. The ordinary illuminating gas was used, mixed with the requisite proportion of oxygen gas, made on the premises and stored in a large gasometer placed near the furnace-room. For obtaining a sufficient blast the power of a 15-horse steam-engine was employed.

In order to facilitate the melting, it was necessary first to divide the larger ingots into small pieces. About half the quantity for a single melting, thus divided into small lumps, was placed in the mould, and when this was completely melted the remainder, which had been drawn out into long thin bars, was introduced gradually through two small holes opposite each other in the furnace. These holes also enabled the interior of the furnace to be seen, together with the progress of the melting, and they could be closed by stone plugs when requisite. The division of the ingots was a difficult operation, as this alloy of platinum and iridium is harder than ordinary steel. A V cut, about $\frac{1}{2}$ in. deep, was made around the ingot with a cold chisel, though not without splintering the edges of a considerable number of the best-tempered chisels. The ingot was then placed under a hydraulic press, supported upon the rounded tops of two strong iron bars, a sufficient distance apart. The rounded part of a third bar was placed upon the ingot, in the line of the cut, and the power of the press being applied, the ingot was broken in half, presenting in every instance a regular crystallised grain.

The melted metal was not cast into a separate mould, but was allowed to cool in the furnace. During the melting a portion of the interior of the stone, to the depth of about half an inch, became coloured by the excessive heat and formed into lime in a powdery state, which floated on the surface of the melted metal. When the metal was sufficiently cool, the stone mould was broken and the ingot removed to a bath of hydrochloric acid, which dissolved every portion of lime or other foreign matter upon the surface of the ingot, but does not act upon platinum-iridium. The ingot was then left quite clean and pure.

The first of the larger ingots of 80 kilogrammes was successfully melted on April 25. The second was melted on May 1, when Marshal MacMahon, the President of the

* After having repeatedly watched in vain the flowers of *Myosotis versicolor*, I succeeded twice in seeing it fertilised by insects, viz.—May 15, 1873, I observed *Bombus agrorum* F. ♀, and June 2, 1873, *Halictus sexnotatus* K. ♀, *H. zonulus* Sm. ♀, *Rhingia rostrata* L., and *Syrphia pipiens* L., all of them successively sucking flowers of different stems. But certainly by far the greatest part of all the flower remains without any visit of insects.

Republic, accompanied by M. Deseilligny, the Minister of Commerce, were present unofficially, and remained during the whole process, appearing to take great interest in the operations. The third of the larger ingots was melted on May 7.

The melting of the great ingot of 250 kilogrammes took place on May 13, in presence of nearly every member of the French Section of the Commission, of M. Struve from St. Petersburg, MM. Stas and Heusschen from Brussels, M. Bosscha from Holland, Prof. Miller and Mr. Chisholm, delegates from Great Britain, and other foreign commissioners. It was successfully accomplished with the greatest facility and regularity, and without the slightest hitch or accident.

The dimensions of the cavity in the furnace, and consequently of the large ingots produced, were as follows:—

	Mètre	Inch
Length	1'24, or about	44'9
Breadth	0'15, "	5'9
Depth	0'07, "	2'8
Thickness of stone above the cavity	0'15, "	5'9

The time occupied in the process was as follows:—

- 2.10 P.M.—Furnace heated and lighted by degrees.
- 2.24 " —Furnace thoroughly heated.
- 3.4 " —Contents of metal (130 kilogrammes) melted and bars begun to be introduced.
- 3.27 " —All the metal melted.
- 4.15 " —Metal entirely solid, but still at white heat; lid lifted.

In about half an hour the mould was broken and the ingot removed to the hydrochloric bath. When taken out it was examined, and found, to all appearance, perfect.

The stone used is so remarkably slow a conductor of heat, that when the whole mass of metal was in a melted state the upper surface of the stone was hardly warm, as was tested by the hands of several of the persons present being placed upon it.

Portions of the three large ingots had been previously tested and found to be very nearly indeed of pure platinum and pure iridium in the proportions of 9 to 1. The large ingot will also be assayed, and, if deemed necessary, again melted, in order that the requisite homogeneity may be attained.

The work of constructing all the new line-standard metres from this single ingot will at once be proceeded with, and there will be sufficient surplus metal for making first all the new standard kilogrammes, and then such number of end-standard metres as may be required.

H. W. CHISHOLM

SOUNDINGS IN THE PACIFIC

THE voyages of the U.S. steamer *Tuscarora*, Capt. Belknap, engaged in soundings for a cable from America to Japan, have been already described between Cape Flattery and Oonalaska Island (vol. ix. p. 150), and between California and the Sandwich Islands. They have now been extended from the last-named station to the coast of Japan. Sixty casts were taken at intervals of about 50 miles. In the first 95 miles from Honolulu, the depth increased at nearly 162 ft. to a mile, reaching 2,418 fathoms in lat. 21° N., long. 159° 20' W. The average depth of all the casts taken during this voyage was 2,450 fathoms. Between the mountains (all but one of which are entirely submarine) the bed of the ocean was very level; the greatest depth was found at lat. 22° 44' N., long. 168° 23' E., 3,262 fathoms. These mountains were as follows:—(1) Summit about lat. 20° 41' N., long. 171° 33' W.; height 5,160 ft.; eastern slope 40 ft. and western 128 ft. to the mile. (2) Summit, lat. 21° 41' N., long. 176° 54' E.; height 12,000 ft.; eastern slope 37 ft. for about 127 miles and 51 ft. thence to summit; western slope

55 ft. (3) Summit 23° 45' N., long. 160° 56' E.; height 9,600 ft.; eastern slope 192 ft.; western 204 ft. (4) Summit, lat. 23° 55' N., long. 158° 7' E.; height 6,000 ft.; eastern slope 60 ft.; western, inappreciable for 45 miles from summit, afterwards 90 ft. per mile to its base. (5) Summit above water, known as Marcus Island, lat. 24° 12' N., long. 153° 57' E. Soundings 7 miles to northward, lat. 24° 20' N., long. 154° 6' E., gave 1,500 fathoms depth; northern slope to this point 1,284 ft. to the mile; eastern slope thence, 200 ft.; western 157 ft. (6) Summit, lat. 25° 42' N., long. 148° 39' E.; height 7,800 ft.; eastern slope 163 ft.; western 59 ft. From the base of the last mountain to Port Lloyd, Peele Island, the upward slope was 86 ft. to the mile. All the slopes are estimated at a minimum.

All specimens brought up from summits of mountains or ridges were white coral or pieces of lava, and indicated otherwise a hard and rocky bottom: all from the level bed were of soft brownish-yellow mud. It will be noticed that the position of Marcus Island has been hitherto incorrectly indicated on the charts—too much to the north and west. It is about 4 miles in length from east to west and is thickly wooded and frequented by large flocks of birds. Another island laid down on the charts as somewhat to the southward of Marcus Island has no existence, and the facts are similar in regard to several reported shoals and rocks indicated on the charts; the *Tuscarora* sailed over their alleged positions, and found from 1,500 to 3,000 fathoms of water.

Bottom temperatures, as in other parts of the Pacific, range from 33°·2 F. to 34°·6 below 1,800 fathoms, whatever the additional depth. Between 1,200 and 1,800 fathoms the temperature rises slowly to about 35° at the former depth. From 1,200 fathoms to the surface the thermometer rose steadily; surface temperatures ranging from 70° to 76° F.

Observations on currents are made from a boat when the sea is moderately smooth. For investigating deep currents the sinker of the apparatus is of about 10 lbs. weight; it consists of four rectangular pieces of doubled tin soldered at right angles to each other, each 6 in. square, and with the requisite quantity of lead attached in strips through holes punched in the lower edges of the sheets. A small silk fishing-line supports the sinker, running through the float, which is a wooden cube 5 in. square at the surface by 4 in. in depth; the line runs to a reel in the boat, having a toggle placed on it just above the float. For observing surface currents a similar sinker is constructed of wood weighted to sink about 2 fathoms. The line attached to it is marked in tenths of knots by small corks, which also prevent errors that would otherwise accrue by the line sinking.

A fixed point of departure is obtained by lowering the sounding apparatus and bringing the sounding wire in a vertical position after bottom is reached. From this point the current-measuring apparatus is thrown overboard, and its rate and direction of progress measured at frequent intervals of time. The small errors due to friction are easily eliminated, and the elements of calculation are exceedingly simple. An approximate method of obtaining the surface current when dredging is by anchoring the boat to the dredge lines as a fixed point. In deep currents the float is vertical over the sinker.

The voyage occupied twenty-eight days, and the weather was exceptionally favourable. There are only sixty-five inhabitants on Peele Island, and the *Tuscarora* was the first visit of a naval vessel for more than seventeen years; Commodore Perry stopped at the island in 1853. A Mr. Savory, formerly a whaler, from Massachusetts, had exercised the functions of governor, consisting principally of presiding over marriages and funerals, for many years, and died last March at the age of eighty, a Mr. Thomas Webb succeeding to the position and honours. In 1827 Capt. Beechy, R.N., took possession of the island